Objective: Since a known growth-of-cartilage framework is used for reconstruction of microtia under the Brent technique, we set out to address the behavior of the framework under the Nagata technique.

Design: A retrospective analysis of costal cartilage auricular reconstruction procedures.


Interventions: Reconstruction of microtia using the 2-stage Nagata technique.

Main Outcome Measures: The parameters checked were patient age at the time of reconstruction, follow-up time, and measurements of the auricular framework height and width both at the time of implantation (represented by the template size) and at follow-up.

Results: A significant change in auricular height and width was observed. The height decreased by 3.1%, while the width increased by 4.0%. This change was not influenced by follow-up time.

Conclusions: Auricular reconstruction with the Nagata technique was undertaken when the patients were aged 9 to 10 years, when the auricle had reached nearly its final size. According to our patient sample, it is our opinion that a policy change is unjustifiable.
previous chest wall incision. Nagata also recommends that the operation not be performed on patients younger than 9 years owing to the smaller cartilage available in younger children.

The growth of the reconstructed framework was an issue first addressed by Tanzer. He conducted a survey with results from subjective impressions of the patients and concluded that growth of the framework was possible with a growth of 3.6 mm. The same issue was addressed by Brent, who conducted a survey in the same manner but with a larger number of participants. Brent reported that 41% of the ears grew larger. However, no firm statistical data such as the number of the returned surveys or the size at the time of implantation and on final measurement were supplied. In addition, in a 4-stage procedure, new cartilage could be added.

The first researchers to address the growth of the reconstructed framework relative to the contralateral ear (and not relative to the template of the reconstructed ear) were Thomson and Winslow, who showed growth rates of 8%. The most significant study, yet still small-scale (only 10 patients), was conducted by DellaCroce et al, who identified growth of 5 mm, reflecting 10% in height and 7% in width.

**METHODS**

Our multiple case studies evaluated 27 patients who underwent reconstruction of microtia according to the Nagata technique. The patients selected represented successful reconstruction cases on the first attempt. The measurements for the height and width were taken from the original template. The second measurement was taken after the second and final stage. The age of the patients was also recorded, and the time factor was addressed by subtracting an arbitrary date set (May 2006) from the original date of the first stage of the operation for each patient.

Comparisons using 2-tailed $t$ tests were conducted to compare the size of the template with the final result. An $F$ test was performed to compare the group before maturity (set as boys younger than 13 years, girls younger than 12 years) and after maturity. The first half of the reconstructed ear cohort was then compared with the second half. All calculations were conducted using Microsoft Excel software (Redmond, Washington; 2002).

**RESULTS**

A total of 27 patients concluded the series, and follow-up time ranged from 9 to 87 months (Figure 1). There were 6 female patients and 1 bilateral repair. Eleven patients underwent the procedure before maturity. The height of the implant ranged from 4.80 to 6.70 cm at the time of implantation, and on final measurement the range was 4.50 to 6.50 cm (Figure 2). The width ranged from 2.90 to 3.80 cm at the time of reconstruction and grew to between 3.00 and 4.00 cm by final measurement (Figure 3).

The mean difference in height for the whole series was −0.18 cm (Table), which was significant ($P = .04$) and represented a 3.1% change. There was a 0.13-cm increase in width for the whole series (Table), which was significant ($P = .03$) and represented a 4.0% change. The height and width changes are illustrated in Figure 4.

The change in height comparing the adult group ($n = 17$) with the children ($n = 11$) was 0.22 cm vs 0.13 cm and was not significant ($P = .60$). Width growth was 0.12 cm for children and 0.13 cm for adults, which was significant ($P = .02$).

We checked the significance of time following the reconstruction and possible implications on framework size.
We addressed the issue of framework change in the auricular reconstruction using the Nagata technique. Our findings reveal that the framework changes its size when the parameters are height and width. We also found that the change is statistically significant: The change was a negative one, −3.1%, when considering height, and a positive one of 4.0% for width. We can also conclude that these changes were not affected by the subgroup of children selected or time factors.

Results from previous studies exclusively using the Brent reconstructive techniques have reported changes of up to 10%. By contrast, to our knowledge, our study is the first to address the issue of framework growth after reconstruction with the Nagata technique. We invite further investigation to corroborate these findings.

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Correspondence: Victor Kizhner, MD, Rahel 6 St, Kiriat-Bialic, 27069 Israel (vic466@zahav.net.il).

Author Contributions: Dr Kizhner had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis. Study concept and design: Kizhner and Barak. Acquisition of data: Kizhner. Analysis and interpretation of data: Kizhner. Drafting of the manuscript: Kizhner. Critical revision of the manuscript for important intellectual content: Barak. Statistical analysis: Kizhner. Study supervision: Barak.

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COMMENT

by comparing the first 14 reconstructions with the later 14. There was no statistical change (P=.34 for height changes and P=.93 for width changes).

### Table. Comparison of Original Implant Size and Size at Final Measurement

<table>
<thead>
<tr>
<th>Implant Measurement</th>
<th>Height Range</th>
<th>Width Range</th>
<th>Mean (SD) Height</th>
<th>Mean (SD) Width</th>
</tr>
</thead>
<tbody>
<tr>
<td>At time of implantation</td>
<td>4.80-6.70</td>
<td>2.90-3.80</td>
<td>5.72 (0.45)</td>
<td>3.24 (0.24)</td>
</tr>
<tr>
<td>Final measure</td>
<td>5.50-6.50</td>
<td>3.00-4.00</td>
<td>5.54 (0.54)</td>
<td>3.37 (0.13)</td>
</tr>
</tbody>
</table>

Table: Comparison of Original Implant Size and Size at Final Measurement

Figure 4. Implant height and width differences.

We conclude that no amenable framework changes can be foreseen when the Nagata technique is undertaken. The final result, as related to size, is also more accurate than with the Brent technique. We invite further investigation to corroborate these findings.

### REFERENCES